

Claims

I Claim:

1. A method for breaking viscosity of aqueous fluids gelled with polysaccharides comprising
adding to an aqueous fluid gelled with at least one polysaccharide, at least one low molecular weight polyol; and
subjecting the polymer and the polyol to heat for an effective period of time and where the concentration of the polyol is effective to break down the polymer backbone directly.
2. The method of claim 1 where in adding the polyol, the polyol has at least one hydroxyl group on two adjacent carbon atoms and is selected from the group consisting of monosaccharides and disaccharides, and acid, acid salt, alcohol, alkyl and amine derivatives of these saccharides.
3. The method of claim 1 conducted in the absence of an oxidizer breaker or an enzyme breaker.
4. The method of claim 1 further comprising raising the pH of the aqueous fluid.
5. The method of claim 4 where the pH of the aqueous fluid is raised with a compound selected from the group consisting of an alkali metal hydroxide, alkali metal carbonate, bicarbonate, sesquicarbonate, and mixtures thereof.
6. The method of claim 1 where in adding the polyol, the polyol is selected from the group consisting of mannitol, sorbitol, xylitol, glycerol, glucose, fructose, maltose, lactose, tagatose, psicose, galactose, xylose, allose, ribose, arabinose,

rhamnose, mannose, altrose, ribopyranose, arabinopyranose, glucopyranose, gulopyranose, galatopyranose, psicopyranose, allofuranose, gulofuranose, galatofuranose, glucosamine, chondrosamine, galactosamine, ethyl-hexo glucoside, methyl-hexo glucoside, aldaric acid, sodium aldarate, glucaric acid, sodium glucarate, gluconic acid, sodium gluconate, glucoheptonic acid, sodium glucoheptonate, and mixtures thereof.

7. The method of claim 1 where in adding the polyol, the amount of polyol added ranges from about 0.01 to about 20 pptg (about 0.0012 to about 2.4 kg/m³) based on the total volume of fluid.

8. The method of claim 1 where in subjecting the polymer and the polyol to heat, the temperature ranges from about 120 to about 270°F (about 49 to about 132°C).

9. The method of claim 1 where in subjecting the polymer and the polyol to heat for an effective period of time, the period of time ranges from about 0.5 to about 48 hours.

10. The method of claim 1 where the polysaccharide is crosslinked.

11. The method of claim 10 where the polysaccharide is crosslinked with an ion selected from the group consisting of borate ion, zirconate ion, titanate ion, and combinations thereof.

12. The method of claim 1 where the polyol is fructose and the amount of fructose added ranges from about 0.01 to about 20 pptg (about 0.0012 to about 2.4 kg/m³) based on the total volume of fluid, and where in subjecting the polymer

and the fructose to heat, the temperature ranges from about 120 to about 180°F (about 49 to about 82°C).

13. The method of claim 12 where in subjecting the polymer and the fructose to heat for an effective period of time, the period of time ranges from about 1.0 to about 48 hours.

14. The method of claim 12 further comprising raising the pH to at least 8.0.

15. The method of claim 1 where the polyol is glucose and the amount of glucose added ranges from about 0.01 to about 20 pptg (about 0.0012 to about 2.4 kg/m³) based on the total volume of fluid, and where in subjecting the polymer and the glucose to heat, the temperature ranges from about 140 to about 220 °F (about 60 to about 105 °C).

16. The method of claim 15 where in subjecting the polymer and the glucose to heat for an effective period of time, the period of time ranges from about 0.5 to about 24 hours.

17. The method of claim 15 further comprising raising the pH to at least 8.0.

18. The method of claim 1 where the polyol is selected from the group consisting of lactose, maltose, mannose, galactose and mixtures thereof, and the amount of polyol added ranges from about 0.01 to about 20 pptg (about 0.0012 to about 2.4 kg/m³) based on the total volume of fluid, and where in subjecting the polymer and the polyol to heat, the temperature ranges from about 180 to about 260°F (about 82 to about 127°C).

19. The method of claim 18 where in subjecting the polymer and the polyol to heat for an effective period of time, the period of time ranges from about 1.0 to about 16 hours.
20. The method of claim 18 further comprising raising the pH to at least 8.0.
21. The method of claim 1 where the polyol is sorbitol and the amount of sorbitol added ranges from about 0.01 to about 10 pptg (about 0.0012 to about 1.2 kg/m³) based on the total volume of fluid, and where in subjecting the polymer and the sorbitol to heat, the temperature ranges from about 120 to about 220°F (about 49 to about 127°C).
22. The method of claim 21 where in subjecting the polymer and the sorbitol to heat for an effective period of time, the period of time ranges from about 0.25 to about 48 hours.
23. The method of claim 21 further comprising raising the pH to at least 8.5.
24. The method of claim 1 where the polyol is alkyl glucoside and the amount of sorbitol added ranges from about 0.25 to about 5.0 gptg based on the total volume of fluid, and where in subjecting the polymer and the sorbitol to heat, the temperature ranges from about 190 to about 250°F (about 88 to about 121°C).
25. The method of claim 24 where in subjecting the polymer and the alkyl glucoside to heat for an effective period of time, the period of time ranges from about 1.0 to about 16 hours.
26. The method of claim 24 further comprising raising the pH to at least 8.0.

27. A method for breaking viscosity of aqueous fluids gelled with polysaccharides comprising
- adding fructose to an aqueous fluid gelled with at least one polysaccharide, where the amount of fructose ranges from about 0.01 to about 20 pptg (about 0.0012 to about 2.4 kg/m³) based on the total volume of fluid; and
 - subjecting the polymer and the polyol to a temperature ranging from about 120 to about 180°F (about 49 to about 82°C) for an effective period of time and where the concentration of the polyol is effective to break down the polymer backbone directly;
- where the method is conducted in the absence of an oxidizer breaker or an enzyme breaker.
28. The method of claim 27 further comprising raising the pH of the aqueous fluid to at least 8.0.
29. The method of claim 28 where the pH of the aqueous fluid is raised with a compound selected from the group consisting of an alkali metal hydroxide, alkali metal carbonate, bicarbonate, sesquicarbonate, and mixtures thereof.
30. The method of claim 27 where the polysaccharide is crosslinked.
31. The method of claim 30 where the polysaccharide is crosslinked with an ion selected from the group consisting of borate ion, zirconate ion, titanate ion, and combinations thereof.
32. A method for breaking viscosity of aqueous fluids gelled with polysaccharides comprising

adding glucose to an aqueous fluid gelled with at least one polysaccharide, where the amount of glucose ranges from about 0.01 to about 20 pptg (about 0.0012 to about 2.4 kg/m³) based on the total volume of fluid; and

subjecting the polymer and the polyol to a temperature ranging from about 140 to about 220°F (about 60 to about 105°C) for an effective period of time and where the concentration of the polyol is effective to break down the polymer backbone directly;

where the method is conducted in the absence of an oxidizer breaker or an enzyme breaker.

33. The method of claim 32 further comprising raising the pH of the aqueous fluid to at least 8.0.

34. The method of claim 33 where the pH of the aqueous fluid is raised with a compound selected from the group consisting of an alkali metal hydroxide, alkali metal carbonate, bicarbonate, sesquicarbonate, and mixtures thereof.

35. The method of claim 32 where the polysaccharide is crosslinked.

36. The method of claim 35 where the polysaccharide is crosslinked with an ion selected from the group consisting of borate ion, zirconate ion, titanate ion, and combinations thereof.

37. A method for breaking viscosity of aqueous fluids gelled with polysaccharides comprising

adding lactose to an aqueous fluid gelled with at least one polysaccharide, where the amount of lactose ranges from about 0.01 to about

20 pptg (about 0.0012 to about 2.4 kg/m³) based on the total volume of fluid; and

subjecting the polymer and the polyol to a temperature ranging from about 180 to about 260°F (about 82 to about 127°C) for an effective period of time and where the concentration of the polyol is effective to break down the polymer backbone directly;

where the method is conducted in the absence of an oxidizer breaker or an enzyme breaker.

38. The method of claim 37 further comprising raising the pH of the aqueous fluid to at least 8.0.

39. The method of claim 38 where the pH of the aqueous fluid is raised with a compound selected from the group consisting of an alkali metal hydroxide, alkali metal carbonate, bicarbonate, sesquicarbonate, and mixtures thereof.

40. The method of claim 37 where the polysaccharide is crosslinked.

41. The method of claim 40 where the polysaccharide is crosslinked with an ion selected from the group consisting of borate ion, zirconate ion, titanate ion, and combinations thereof.

42. A method for breaking viscosity of aqueous fluids gelled with polysaccharides comprising

adding alkyl glucoside to an aqueous fluid gelled with at least one polysaccharide, where the amount of alkyl glucoside ranges from about 0.25 to about 5.0 gptg based on the total volume of fluid; and subjecting the polymer and the polyol to a temperature ranging from about 190 to about 250°F (about 88 to about 121°C) for an effective

period of time and where the concentration of the polyol is effective to break down the polymer backbone directly;
 where the method is conducted in the absence of an oxidizer breaker or an enzyme breaker.

43. The method of claim 42 further comprising raising the pH of the aqueous fluid to at least 8.0.

44. The method of claim 43 where the pH of the aqueous fluid is raised with a compound selected from the group consisting of an alkali metal hydroxide, alkali metal carbonate, bicarbonate, sesquicarbonate, and mixtures thereof.

45. The method of claim 44 where the polysaccharide is crosslinked.

46. The method of claim 45 where the polysaccharide is crosslinked with an ion selected from the group consisting of borate ion, zirconate ion, titanate ion, and combinations thereof.

47. An aqueous fluid comprising:
 at least one polysaccharide gel;
 at least one polyol, in an amount effective to eventually reduce the pH of the fluid and break down the polysaccharide backbone directly; and
 water;
 in the absence of an oxidizer or an enzyme.

48. The fluid of claim 47 where the polyol has at least one hydroxyl group on two adjacent carbon atoms and is selected from the group consisting of monosaccharides and disaccharides, and acid, acid salt, alcohol, alkyl and amine derivatives of these saccharides.

49. The fluid of claim 47 further comprising a compound selected from the group consisting of an alkali metal hydroxide, an alkali metal carbonate, bicarbonate, sesquicarbonate, and mixtures thereof to raise the pH to at least 8.0.

50. The fluid of claim 47 where the polyol is selected from the group consisting of mannitol, sorbitol, glycerol, xylitol, glucose, fructose, maltose, lactose, tagatose, psicose, galactose, xylose, allose, ribose, arabinose, rhamnose, mannose, altrose, ribopyranose, arabinopyranose, glucopyranose, gulopyranose, galatopyranose, psicopyranose, allofuranose, gulofuranose, galatofuranose, glucosamine, chondrosamine, galactosamine, ethyl-hexo glucoside, methyl-hexo glucoside, aldaric acid, sodium aldarate, glucaric acid, sodium glucarate, gluconic acid, sodium gluconate, glucoheptonic acid, sodium glucoheptonate, and mixtures thereof.

51. The fluid of claim 47 where the polyol is selected from the group consisting of fructose, glucose, lactose, maltose, sorbitol, or alkyl glucoside.

52. The fluid of claim 47 where the amount of polyol ranges from about 0.01 to about 20 pptg (about 0.0012 to about 2.4 kg/m³) based on the total volume of fluid.

53. The fluid of claim 47 where the polysaccharide is crosslinked.

54. The fluid of claim 52 where the polysaccharide is crosslinked with an ion selected from the group consisting of borate ion, zirconate ion, titanate ion, and combinations thereof.

55. The fluid of claim 47 where the polyol is fructose and the amount of fructose added ranges from about 0.01 to about 20 pptg (about 0.0012 to about 2.4 kg/m³) based on the total volume of fluid.

56. An aqueous fluid comprising:
 at least one polymer crosslinked with an ion of borate, zirconate, titanate, and combinations thereof;
 at least one polyol, in an amount effective to eventually reduce the pH of the fluid, break down the polysaccharide backbone directly, and remove at least a portion of ion from the crosslinked polymer;
 at least one enzyme; and
 water;

where the effective amount of polyol ranges from about 0.01 to 10.0 pptg (about 0.012 to 1.2 kg/m³) based on the total volume of fluid.

57. The fluid of claim 56 where the polyol has at least one hydroxyl group on two adjacent carbon atoms.

58. The fluid of claim 56 where the polyol is selected from the group consisting of monosaccharides and disaccharides, and acid, acid salt, alcohol, alkyl and amine derivatives of these saccharides.

59. The fluid of claim 56 where the polyol is selected from the group consisting of mannitol, sorbitol, glycerol, xylitol, glucose, fructose, maltose, lactose, tagatose, psicose, galactose, xylose, allose, ribose, arabinose, rhamnose, mannose, altrose, ribopyranose, arabinopyranose, glucopyranose, gulopyranose, galatopyranose, psicopyranose, allofuranose, gulofuranose, galatofuranose, glucosamine, chondrosamine, galactosamine, ethyl-hexo glucoside, methyl-hexo glucoside, aldaric acid, sodium aldarate, glucaric acid, sodium glucarate, gluconic

acid, sodium gluconate, glucoheptonic acid, sodium glucoheptonate, and mixtures thereof.

60. The fluid of claim 56 where the enzyme is selected from the group consisting of hemi-cellulases, cellulases, pectinases, and alpha-amylases.

61. The fluid of claim 56 where the amount of enzyme ranges from about 0.001 to about 5.0 gptg based on the total volume of fluid.

62. The fluid of claim 61 where the crosslinked polymer is a guar or guar-based polymer and the enzyme is effective to break linkages selected from the group consisting of 1,4- β -D-mannosidic linkages; 1,6- α -D-glactomannosidic linkages; and mixtures thereof at a pH in the range of from about 2 to about 11.